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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte SERGEY D. LOPATIN, PAUL R. BESSER,
and PIN-CHIN CONNIE WANG

Appeal 2008-5997
Application 09/994,395
Technology Center 2800

Decided: January 27, 2009

Before MAHSHID D. SAADAT, JOHN A. JEFFERY, and MARC S. HOFF, *Administrative Patent Judges*.

JEFFERY, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134 from the Examiner's rejection of claims 1-4, 6, 8-13, 15-20, 22, and 23. We have jurisdiction under 35 U.S.C. § 6(b). We affirm.

STATEMENT OF THE CASE

Appellants invented a method for making integrated circuits. The method includes using a ternary copper alloy to form a via of low resistance and large grain size that promotes electromigration reliability.[1] Independent claim 1 is reproduced below:

> 1. A method of fabricating an integrated circuit, the method comprising:
>
> depositing an etch stop layer over a first conductive layer, wherein the etch stop layer is in direct contact with the first conductive layer;
>
> depositing an insulating layer after the etch stop layer is deposited over the etch stop layer;
>
> forming a barrier layer extending along lateral side walls and a bottom of a via aperture, the via aperture being configured to receive a via material that electrically connects the first conductive layer and a second conductive layer; and
>
> depositing a copper alloy via material in the via aperture to form a via, the copper alloy material including Zinc (Zn) or Silver (Ag) and at least one element for increasing grain size including Calcium (Ca) or Chromium (Cr).

The Examiner relies upon the following as evidence in support of the rejection:

Andricacos	US 6,090,710	Jul. 18, 2000
Gross	US 6,380,083 B1	Apr. 30, 2002 (filed May 10, 2000)
Edelstein	US 6,399,496 B1	Jun. 4, 2002 (filed Nov. 16, 2000)

[1] *See generally* Spec. ¶¶ 13, 32, and 33.

Merchant	US 6,440,849 B1	Aug. 27, 2002 (filed Oct. 18, 1999)
Bögel	US 6,749,699 B2	Jun. 15, 2004 (filed Aug. 6, 2001)

1. Claims 1-3, 6, 10, 15, 17-20, and 22 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Edelstein and Bögel (for purposes of showing an inherent characteristic of Edelstein) (Ans. 3-4).

2. Claims 8, 13, and 16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Edelstein and Bögel (Ans. 5).

3. Claim 4 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Edelstein, Bögel, and Merchant (Ans. 5-6).

4. Claims 9 and 23 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Edelstein, Bögel, and Gross (Ans. 6).

5. Claims 11 and 12 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Edelstein, Bögel, and Andricacos (Ans. 6-7).

Rather than repeat the arguments of Appellants or the Examiner, we refer to the Briefs and the Answer[2] for their respective details. In this decision, we have considered only those arguments actually made by Appellants. Arguments, which Appellants could have made but did not make in the Briefs, have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii).

[2] Throughout this opinion, we refer to (1) the most recent Appeal Brief filed January 3, 2008, (2) the Examiner's Answer mailed March 31, 2008, and (3) the Reply Brief filed June 2, 2008.

ANTICIPATION REJECTION

Regarding representative independent claim 1,[3] the Examiner finds that Edelstein discloses all the limitations in claim 1, including "at least one element for increasing grain size including Calcium (Ca) or Chromium (Cr)" (Ans. 3-4). The Examiner cites to Bögel for purposes of showing an inherent characteristic of Edelstein (Ans. 4). Appellants argue that: (1) Edelstein does not anticipate claim 1 because the reference does not mention grain size; (2) the Examiner has provided no evidence to support the assertion that Edelstein inherently discloses at least one element for increasing grain size as required by MPEP 2112; and (3) Bögel relates grain growth to annealing and fails to show explicitly or inherently an element for increasing grain size (App. Br. 7-10; Reply Br. 2-3).

ISSUE

The following issue has been raised in the present appeal:

Have the Appellants shown that the Examiner erred in finding Edelstein inherently discloses "at least one element for increasing grain size" in rejecting claim 1 under § 102?

FINDINGS OF FACT

The record supports the following findings of fact (FF) by a preponderance of the evidence.

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[3] Appellants do not argue independent claims 10 and 17 separately from claim 1. Additionally, Appellants have not particularly argued claims 2, 3, 6, 15, 18-20, and 22 (Br. 7-10). Accordingly, we select independent claim 1 as representative. 37 C.F.R. § 41.37(c)(1)(vii).

1. Edelstein discloses depositing a seed layer made from a copper alloy having one or more of the following materials: zinc (Zn), silver (Ag), calcium (Ca), and chromium (Cr) (Edelstein, col. 8, ll. 35-52).
2. Appellants have not challenged that Edelstein discloses a ternary copper alloy including (a) zinc or silver and (b) calcium or chromium.
3. Edelstein discloses the seed layer provides a thin layer with nucleation growth characteristics (Edelstein, col. 7, ll. 54, 55, and 62-65).
4. The Specification explains that an element with a characteristic for increasing grain size includes calcium or chromium (Spec. ¶ 32).
5. Claim 15 recites "the element with a characteristic for increasing grain size is Calcium (Ca) or Chromium (Cr)."
6. Edelstein discloses that the seed layer 76 initiates the chemical reaction for the deposition of copper conducting layers 56 and 60 and can provide electrical continuity (Edelstein, col. 7, ll. 54-62; Fig. 2).

PRINCIPLES OF LAW

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros, Inc. v. Union Oil Co. of Calif., Inc.*, 814 F.2d 628, 631 (Fed. Cir. 1987).

During examination of a patent application, a claim is given its broadest reasonable construction "in light of the specification as it would be interpreted by one of ordinary skill in the art." *In re Am. Acad. Of Sci. Tech. Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004). "'Functional' terminology may render a claim quite broad. By its own literal terms a claim employing such

language covers any and all embodiments which perform the recited function." *In re Swinehart*, 439 F.2d 210, 213 (CCPA 1971).

The mere recitation of a newly discovered function or property that is inherently possessed by the prior art does not distinguish over the prior art. *Swinehart*, 439 F.2d at 212-13. The court explains:

> where the Patent Office has reason to believe that functional limitation asserted to be critical for establishing novelty in the claimed subject matter may, in fact, be an inherent characteristic of the prior art, it possesses the authority to require the applicant to prove that the subject matter shown to be in the prior art does not possess the characteristic relied on.

In re Schreiber, 128 F.3d 1473, 1478 (Fed. Cir. 1997) (quoting *Swinehart*, 439 F.2d at 213).

ANALYSIS

We begin our analysis by discussing the scope of claim 1. Appellants have chosen to define the "at least one element for increasing grain size" of the deposited copper alloy via material functionally. That is, this limitation describes the copper alloy not structurally but in terms of an increasing grain size characteristic. *See Swinehart*, 39 F.2d at 212-13; *Schreiber*, 128 F.3d at 1478. In addition, without further explanation of the amount of the element needed to increase grain size, the Specification states that calcium and chromium have the characteristic of increasing grain size (FF 4). The above-quoted recitation also does not relate or limit the element's ability to increase grain size to another material. Thus, giving the above-quoted limitation its broadest reasonable interpretation in light of the Specification, the limitation of "at least one element for increasing grain size" covers any

and all elements that posses the characteristic of increasing grain size relative to any material. *See Am. Acad. Of Sci. Tech.*, 367 F.3d at 1364.

Edelstein discloses a seed layer that can have one or more of the following elements: zinc, silver, calcium, and chromium (FF 1). Appellants have not challenged that Edelstein discloses a ternary copper alloy containing at least calcium or chromium (FF 2). The Examiner takes the position that this copper alloy, that includes calcium and chromium, inherently has at least one element for increasing grain size as claimed (Ans. 4 and 9). The Specification, along with claim 15, further supports the Examiner's position that the element with a characteristic for increasing grain size includes calcium or chromium (FF 4-5). The Specification also does not describe that a specific proportion or percentage of calcium or chromium is necessary in order to obtain the characteristic for increasing grain size. Edelstein also states the seed layer provides a thin layer with nucleation growth characteristics (FF 3). Thus, contrary to Appellants' statements (App. Br. 7-9), we find that the Examiner has reasonably demonstrated that Edelstein's copper alloy that includes calcium or chromium inherently has the characteristic of a copper alloy via material having "at least one element for increasing grain size including Calcium (Ca) or Chromium (Cr)" as recited in claim 1.

Regarding Appellants' assertion that the Examiner must provide evidence (App. Br. 8), MPEP 2112 (IV) requires a rationale *or* evidence that the copper alloy in Edelstein necessarily has the increasing grain characteristic. As demonstrated above, the Examiner has provided such a rationale for concluding that Edelstein's copper alloy having at least one element that includes calcium or chromium inherently possesses the

increasing grain characteristic. Thus, once the Office has provided this explanation, the Office has the authority to require Appellants to demonstrate the disclosed element in Edelstein does not possess the characteristic of increasing grain size as recited in claim 1. *See Schreiber*, 128 F.3d at 1478 (citation omitted). Appellants provide no evidence but rather allege that the Examiner has not met his burden of showing that Edelstein has a copper alloy with at least one element for increasing grain size (Br. 7-9).

Furthermore, as explained in *In re Crish*, 393 F.3d 1253, 1258 (Fed. Cir. 2004) (citations omitted), there are many cases that confirm "one cannot establish novelty by claiming a known material by its properties." For example, based on the evidence in *Titanium Metal Corp. of Am. v. Banner*, 778 F.2d 775, 781-82 (Fed. Cir. 1985), the court found the prior art disclosed the known chemical structure recited in the claim and inherently met the limitation of an alloy "characterized by good corrosion resistance in hot brine environments," even though the prior art was silent regarding this characteristic. Similarly, based on the record before us, Appellants are claiming a known material by its properties. Such a discovery of a new property of a known material, however, cannot establish novelty. *Crish*, 393 F.3d at 1258.

Appellants next argue (for the first time, in the Reply Brief) that the seed layer in Edelstein does not meet the limitation of "depositing a copper alloy via material in the via aperture to form a via" as recited in claim 1 or a ternary copper alloy via electrically connecting the first and second conductive layers in claims 10 and 17 (Reply Br. 2). These arguments were

not timely raised in the Appeal Brief, but rather were brought up for the first time in the Reply Brief. As such, this argument is waived.[4]

Finally, as Edelstein discloses all the limitations of claim 1, we find that the reliance on Bögel cumulative and unnecessary.

For the foregoing reasons, Appellants have not shown the Examiner erred in rejecting claim 1 as being anticipated by Edelstein. Accordingly, we will sustain the Examiner's rejection of that claim, and claims 2, 3, 6, 10, 15, 17-20, and 22 which fall with claim 1.

OBVIOUSNESS REJECTION OVER EDELSTEIN AND BÖGEL

Representative claim 8[5] recites the element with a characteristic for increasing grain size is one atomic percent or less of chromium (Cr). The Examiner found that the combination of Edelstein and Bögel disclose this limitation (Ans. 5). Appellants first argue that neither Edelstein nor Bögel disclose or teach the limitation of the copper alloy having at least one element for increasing grain size (App. Br. 11). As discussed above, we are

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[4] *See Optivus Tech., Inc. v. Ion Beam Appls. S.A.*, 469 F.3d 978, 989 (Fed. Cir. 2006) ("[A]n issue not raised by an appellant in its opening brief … is waived.") (citations and quotation marks omitted). In any event, the seed layer 76 of Edelstein initiates the chemical reactions for the deposition of copper conducting layers 56 and 60 (FF 6). Through chemical initiation, the seed layer becomes part of the via and is, therefore, a copper alloy via material in the via aperture that forms part of the via along with conductor layers 56 and 60. Additionally, since the seed layer also provides electrical continuity (FF 6), Edelstein discloses the alloy electrically connects the first and second conducting layers as recited in claims 10 and 17.

[5] With the exception of the heading, Appellants have not particularly argued claims 8, 13, and 16 (Br. 11). Accordingly, we select claim 8 as representative. 37 C.F.R. § 41.37(c)(1)(vii).

not persuaded by this argument for the reasons previously discussed in connection with claim 1. Appellants also argue that there is no suggestion to combine Edelstein with Bögel since Bögel is directed to automotive applications and is not analogous to Appellants' invention (App. Br. 9 and 11).

ISSUE

The following issue has been raised in the present appeal:

Is Bögel in the same field as Appellants' endeavor or reasonably pertinent to the problem with which the inventor was concerned such that Bögel is analogous art and thus properly combinable with Edelstein in rejecting the claims under § 103?

ADDITIONAL FINDINGS OF FACT

The record supports the following additional findings of fact (FF) by a preponderance of the evidence.

7. Appellants' invention relates to making integrated circuits (Spec. ¶ 3).
8. Bögel states the copper alloy containing chromium and silver is particularly suited for electrical connector applications and states the alloy is used in computer and automotive applications (Bögel, col. 3, ll. 57-59 and col. 4, ll. 61-67).
9. Edelstein discloses the invention relates to producing interconnections in electronic devices and the interconnection structure for electrical connections for electronic devices, including semiconductors (Edelstein, col. 1, ll. 8-17).

PRINCIPLES OF LAW

"The analogous-art test requires that the Board show that a reference is either in the field of the applicant's endeavor or is reasonably pertinent to the problem with which the inventor was concerned in order to rely on that reference as a basis for rejection." *In re Kahn*, 441 F.3d 977, 986-87 (Fed. Cir. 2006) (citing *Oetiker,* 977 F.2d at 1447).

ANALYSIS

Appellants' invention relates to making integrated circuits with copper alloys, which involves creating electrically conductive connections for electrical components (FF 7). Thus, under the analogous art test set forth in *Kahn*, 441 F.3d at 986-87, the Board must show that Bögel is either in the field of creating electrical connections for electrical components or is reasonably pertinent to the problem with which the inventor was concerned. Bögel explains that the copper alloy is "particularly suited for electrical connector applications," including computer applications (FF 8). Bögel is, therefore, within Appellants' field of endeavor related to using copper alloys in electrical conductive applications and is analogous. Edelstein similarly is analogous art as the reference discloses producing interconnections in electronic devices, including semiconductors or integrated circuits (FF 9). Thus, the cited references are analogous and properly combinable under § 103.

For the foregoing reasons, Appellants have not shown the Examiner erred in rejecting claims 8, 13, and 16 as being unpatentable over Edelstein and Bögel.

OBVIOUSNESS REJECTION OVER EDELSTEIN, BÖGEL, AND MERCHANT

Claim 4 recites that the copper alloy via material includes one atomic percent or less of zinc or silver. The Examiner finds the combination of Edelstein and Merchant teaches this limitation (Ans. 5-6). Appellants repeat the arguments that: (1) neither Edelstein nor Bögel alone or in combination teach the increasing grain size limitation of claim 1 and (2) there is no suggestion or motivation to combine Edelstein with Bögel (App. Br. 12). We are not persuaded by these arguments, however, for the reasons previously discussed in connection with claims 1 and 8. We also find such arguments fall well short of rebutting the Examiner's rejection under obviousness – a position that we find reasonable. Additionally, as Edelstein discloses the purported missing increasing grain size limitation, we need not address whether Merchant (App. Br. 12) teaches this recitation.

For the foregoing reasons, Appellants have not shown the Examiner erred in rejecting claim 4 as being unpatentable over Edelstein, Bögel, and Merchant.

OBVIOUSNESS REJECTION OVER EDELSTEIN, BÖGEL, AND GROSS

Representative claim 9[6] recites the increased grain size is between 0.5 and 3 μm. The Examiner finds the combination of Edelstein and Gross teach this limitation (Ans. 6). Appellants repeat the argument that neither Edelstein nor Bögel alone or in combination teach the increasing grain size limitation of claim 1 (App. Br. 12-13). We are not persuaded by these

[6] Appellants have nominally argued claim 23 and essentially repeat the arguments of claim 9 (App. Br. 12-13). Accordingly, we select claim 9 as representative. 37 C.F.R. § 41.37(c)(1)(vii).

arguments, however, for the reasons previously discussed in connection with claim 1. In addition, as Edelstein discloses the purportedly missing increasing grain size limitation, we need not address whether Gross (App. Br. 12) teaches this recitation.

Appellants also state there is no suggestion or motivation to combine the Edelstein with Soininen (App. Br. 13). As Soininen forms no part of the rejection of claim 9, we find this argument does not address the rejection before us. However, to the extent Appellants intended to state that there is no motivation to combine Bögel with Gross, Appellants merely assert and do not specifically explain why there is no motivation to combine the references. Arguments made by counsel do not take the place of evidence in the record. *In re Schulze*, 346 F.2d 600, 602 (CCPA 1965); *see also In re Geisler*, 116 F.3d 1465 (Fed. Cir. 1997). In any event, such conclusory statements fall well short of rebutting the Examiner's rejection under obviousness – a position that we find reasonable.

For the foregoing reasons, Appellants have not shown the Examiner erred in rejecting claims 9 and 23 as being unpatentable over Edelstein, Bögel, and Gross.

OBVIOUSNESS REJECTION OVER EDELSTEIN, BÖGEL, AND ANDRICACOS

The Examiner finds the combination of Edelstein, Bögel, and Adricacos teaches the limitations of claims 11 and 12 (Ans. 6-7). Appellants repeat the arguments that: (1) neither Edelstein nor Bögel teach the increasing grain size limitation and (2) there is no suggestion or motivation to combine Edelstein with Bögel (App. Br. 13). We are not persuaded by these arguments, however, for the reasons previously discussed in

connection with claims 1 and 8. We also find such arguments fall well short of rebutting the Examiner's rejection under obviousness – a position that we find reasonable. Additionally, as Edelstein disclose the purportedly missing increasing grain size limitation, we need not address whether Andricacos (App. Br. 13) teaches this recitation.

For the foregoing reasons, Appellants have not shown the Examiner erred in rejecting claims 11 and 12 as being unpatentable over Edelstein, Bögel, and Andricacos.

CONCLUSION

(1) Appellants have not shown that the Examiner erred in finding Edelstein inherently discloses "at least one element for increasing grain size" in rejecting claim 1 under § 102.

(2) Bögel is in the same field of endeavor as Appellants' invention such that Bögel is analogous art and thus properly combinable with Edelstein in rejecting claims 4, 8, 9, 11-13, 16, and 23 under § 103.

(3) Appellants have not shown the Examiner erred in finding the combination of Edelstein and other prior art fail to teach or suggest the limitations in rejecting claims 4, 8, 9, 11-13, 16, and 23 under § 103.

DECISION

The decision of the Examiner to reject claims 1-4, 6, 8-13, 15-20, 22, and 23 is affirmed.

No period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

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